

Fifty-five Consecutive Laparoscopic Appendectomy Procedures Without Conversion

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ABSTRACT

Background: In patients with suspected appendicitis, laparoscopic appendectomy is gaining increasing acceptance primarily because it is associated with less postoperative pain and a shorter hospital stay. Experience with 55 consecutive laparoscopic appendectomies, performed without conversion by the same surgeon, is herein examined and analyzed.

Methods: The medical records of 55 consecutive patients with suspected appendicitis who underwent laparoscopic exploration (from 2000 to 2002) were analyzed for demographic information, clinical findings, laboratory/computed tomography scan results, intraoperative diagnosis, clinico-pathologic correlation, complications, incidental findings, and operative time.

Results: Twenty-six males (47%) and 24 females (53%) underwent surgery. Mean age was 25.2 years (range, 6 years to 67 years). Computerized tomography scans obtained in 37 cases (74%) had a sensitivity of 86.7% and a specificity of 62.5%. Average length of stay was 2.3 days (median, 1 day). Average operating room time was 69 minutes (range, 40 to 173 minutes). Five patients experienced postoperative complications: 2 had intraperitoneal abscesses, 1 had urinary retention, and 2 had postoperative ileus. No operative conversions or postoperative wound infections occurred.

Conclusion: Laparoscopy confirmed the clinical diagnosis of acute appendicitis and allowed the safe, effective treatment of both complicated and uncomplicated appendicitis with minimal hospitalization, recovery and convalescent times, and zero open conversion and wound infections. Laparoscopic appendectomy is advocated as the procedure of choice for patients with clinically suspected appendicitis.

Key Words: Appendicitis, Laparoscopic-assisted appendectomy.

INTRODUCTION

Appendicitis has been one of the most elusive definitive diagnoses to establish, notwithstanding Reginald H. Fitz's initial description in 1886 of the pathophysiology underlying the development of a pelvic abscess from a perforated appendicitis.¹ Ever since a surgical approach to the disease was adopted, consistent efforts have been made to achieve optimal diagnostic ability and therapeutic technique in the management of this common problem. The acceptance of laparoscopic cholecystectomy as the standard of care for uncomplicated gallbladder pathology during the last decade has encouraged surgeons to attempt to use endoscopic techniques to perform a multitude of traditionally open operations. Procedures, such as colon resection, nephrectomy, adrenalectomy, and splenectomy, which were initially thought to be outside the realm of endoscopic surgery, have now become possible and practical with advanced laparoscopic technology and techniques. Despite early reluctance by some surgeons, laparoscopy in patients with a clinically suspected acute appendicitis is gaining increasing acceptance; however, the literature cites no obvious advantage over the time-tested open technique, which continues to be associated with a 10% to 20% morbidity rate.² Laparoscopic appendectomy has even become the standard of care at a few institutions because it is associated with less postoperative pain, minimal morbidity, improved cosmetic results, and a shorter overall length of hospital stay and rehabilitation compared with the traditional open technique. This retrospective analysis evaluates one surgeon's operative experience with 55 consecutive cases of clinical appendicitis treated laparoscopically at a single institution.

METHODS

The medical records of 55 consecutive patients admitted with a suspected diagnosis of appendicitis by 1 surgeon between July 1, 2000 and June 1, 2002 were reviewed retrospectively. All patients underwent laparoscopic exploration for diagnosis and treatment. Medical records were analyzed for demographic information, clinical findings, laboratory tests, computed tomography (CT) scan findings, intraoperative diagnosis and clinico-patho-

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logic correlation. Also noted were complications, incidental findings, and operative times. Patients with any adenexal or pelvic pathology were also included in the review. Normal appendices were removed in patients who had severe inflammation in the right lower quadrant secondary to gynecologic or pelvic pathology. Those with no evidence of other pathology had a normal appendix removed to eliminate appendicitis as a potential diagnosis of future right lower quadrant pain. No patients were pregnant. A senior surgical resident, the attending surgeon, or both made the diagnosis of acute appendicitis and the decision to perform laparoscopy.

Standard anesthetic and pain management techniques were used. Preoperatively, all patients received a dose of antibiotics and were adequately fluid resuscitated. The laparoscopic appendectomies were all performed in the following manner. After the abdomen was prepared with povidone-iodine solution, a small infraumbilical incision was made and dissection was carried down to the level of the fascia, which was grasped with toothed clamps and elevated. A Veress needle was then placed into the abdominal cavity, which was subsequently insufflated with CO₂ to 15 mm Hg. A 12-mm port was placed through the fascia for insertion of a 5-mm camera. Two 5-mm ports were then placed under direct vision, both in the midline between the pubic symphysis and the umbilicus. After the abdomen was thoroughly examined for any other pathology, the appendix was localized and mobilized. A window was then made in the mesentery, and the camera was transferred to one of the 5-mm ports. A linear endovascular stapler with a tissue refill (3.5 mm) was then inserted into the umbilical port and used to transect the base of the appendix after it was freed from any adhesions. The mesentery of the appendix was dissected anatomically, and it was also transected with a linear endoscopic stapler using a vascular refill (2.5 mm). Standard clips were used to control any bleeding that could not be controlled with standard laparoscopic techniques. The appendix was then placed into a specimen retrieval bag and removed through the umbilical port. Prior to exhausting the CO₂ from the abdomen, the port sites were inspected for bleeding before and after removal. The fascia at the umbilical defect was then reapproximated with #0 Vicryl suture. The skin was then reapproximated using #4-0 Vicryl dermal sutures and then secured with adhesive strips. The procedures may have varied slightly depending on the findings in individual cases. In managing perforated appendicitis, puru-

lent material was sampled for culture and sensitivities followed by thorough pulse irrigation with high shear forces. Jackson-Pratt drains were then placed into the pelvis, exiting through one of the two 5-mm port sites. All operative procedures were performed within the context and environment of a general surgery residency training program.

Immediately postoperatively, patients were allowed oral fluids, and on the first postoperative day, they were offered a regular diet as tolerated. Analgesia was delivered either via patient-controlled intravenous analgesia, oral analgesics, or a combination of both, depending on the patient's preference. The decision to discharge the patient was made based on the patient's ability to tolerate a regular diet and remain afebrile for a 24-hour period.

RESULTS

During the 1 year, 6 month study period, 26 males (47%) and 29 females (53%) underwent laparoscopic explorations for suspected appendicitis. No conversions to open appendectomy were required or indicated. Fifty-three of the 55 patients had appendectomies performed, including those who had a normal-appearing appendix. One patient who did not have an appendectomy clearly had an inflammatory phlegmon and abscess in the right lower quadrant. A Jackson-Pratt drain was placed, and 6 weeks later he underwent an uneventful interval appendectomy laparoscopically. The other patient had a bleeding ovarian cyst that was cauterized to achieve hemostasis. The mean age of the study group was 25.2 years (range, 6 to 67 yrs). A computed tomography scan of the abdomen and pelvis was obtained in 38 cases (74 %) with a sensitivity of the 86.7% and a specificity of 62.5%.

Forty-four patients had pathologically confirmed acute appendicitis. Eight men, accounting for 14% of the male population, had perforated appendicitis. The average age of men with perforated appendicitis was 34 years (range, 13 to 48 yrs). The only woman with a perforation was 67 years old, representing 2% of the females. One patient with perforated appendicitis underwent an interval laparoscopic appendectomy 6 weeks after initial laparoscopic abscess drainage. Another patient with perforated appendicitis, who was discharged home without oral antibiotics, returned 5 days later with a pelvic abscess. He underwent laparoscopic lavage and 3 days later had a CT-guided drainage of a pelvic abscess. The incidental appendectomy rate among women was 20% versus 0%

among men. Of those patients without appendicitis, 2 patients had pelvic inflammatory disease, 2 had endometriosis, 1 had Crohn's disease, 1 had a bleeding ovarian cyst, 1 had cecal adhesions, and 1 had an incidental appendiceal carcinoid tumor. Six patients had a retrocecal appendix, of which 3 were in the infrahepatic position. An incarcerated umbilical hernia and a small bowel obstruction were treated concurrently with appendectomies in 2 patients. Four unilateral and 2 bilateral inguinal hernias were found incidentally, but not repaired at that time.

Laparoscopic exploration failed to reveal appendicitis in 7 of 29 women (24%) compared with 1 of 26 men (4%), with only a single patient having a completely negative exploration. The average operating room time to complete the procedure was 69 minutes, ranging from 40 minutes to 173 minutes. The average length of stay for all patients was 2.3 days (median, 1 day). Patients with perforated, complicated appendicitis had an average hospital stay of 3.8 days (median, 4 days), whereas those with acute, uncomplicated appendicitis averaged 1.6 days (median, 1 day). One patient had a hospital stay of 23 days for drainage of a complicated intraperitoneal abscess. Five (11%) postoperative complications occurred: an intraperitoneal abscess necessitating CT-guided drainage in 2 patients (including laparoscopic lavage in 1 patient with perforated appendicitis), urinary retention in 1 patient, and postoperative ileus in 2 patients. No postoperative wound infections occurred (defined as any area of fluctuance or erythema associated with the wound that required drainage).

DISCUSSION

The benefits of laparoscopic appendectomy have been questioned because the open technique is essentially a minimally invasive procedure associated with low morbidity.³ Some surgeons are reluctant to accept laparoscopic appendectomy as the procedure of choice because it has not proven to have unequivocal benefits over the traditional open procedure. Despite surgical advances, open appendectomy can still be associated with significant postoperative morbidity, particularly wound infection and abscess formation.⁴⁻⁸ Laparoscopic appendectomy has been associated with a decreased morbidity rate in both complicated and uncomplicated appendicitis. Conflicting reports from both prospective randomized and nonrandomized studies regarding which is the superior procedure continue to appear in the liter-

ature.^{2,5,6,8-19} This experience with 55 consecutive laparoscopic appendectomies performed by the same surgeon trained in advanced laparoscopy suggests that this procedure has advantages over the open technique because the patients had no postoperative wound infections and a shorter hospital stay compared with the data published in the literature for the open procedure.³

The absence of wound infections in this series is attributed to the use of thorough irrigation as well as placement of the appendix in a specimen retrieval bag prior to removal from the abdomen. The small number of intraabdominal abscesses and absence of wound infections are also attributed to meticulous inspection and copious irrigation of all quadrants, particularly the paracolic gutters and left lower quadrant. Because it is the most dependent portion of the pelvis, the pouch of Douglas was given particular attention, and in the case of perforated appendicitis, care was taken to irrigate the pelvis until all of the effluent was clear. The use of an endovascular linear stapler to transect the appendix was helpful in avoiding stump complications. The experience of the surgeon contributed greatly to the zero conversion rate. Variations in laparoscopic experience may account for differing conversion rates in the literature.⁴

The 24% misdiagnosis rate among women in this series is consistent with published rates of 23% to 47%.²⁰ Examination of the ovaries, fallopian tubes, and small bowel is limited when performing an open appendectomy, and, therefore, pathology outside of the right lower quadrant may be missed when performing an open appendectomy and removing an otherwise normal appendix for suspected acute appendicitis. Despite literature to support a decision not to remove a normal-appearing appendix when no other pathology is evident during laparoscopy, the appendix was removed in all but 1 patient in this series.²¹ The only patient in whom the appendix was not removed was a 25-year-old female with a bleeding ovarian cyst. All of the other patients had their appendix removed. Those with endometriosis had their appendix removed so future exacerbations of the disease would not be mistaken for appendicitis. The patients with pelvic inflammatory disease underwent an appendectomy because of the fibrosis and inflammation in the region of the appendix and the high propensity that they would likely return in the future with similar right lower quadrant pain. The patient with Crohn's disease underwent appendectomy because of the thickened and inflamed nature of the terminal ileum and appendix

as well as the turbid, yellow fluid in the region. The patient with an appendiceal carcinoid had a perforated appendix at the time of exploration necessitating removal of the appendix. The rationale for removing a normal-appearing appendix in the absence of other intraabdominal pathology is that subclinical or early appendicitis is often apparent on pathologic review. Additionally, the appendix is eliminated as a source of right lower quadrant pain should the patient present in the future with signs and symptoms of appendicitis. This is analogous to the logic underlying removal of a normal appendix when performing an open appendectomy.

Although the overall misdiagnosis rate between open and laparoscopic appendectomy may remain the same, the ability of the surgeon to diagnose and treat other intraabdominal pathology more specifically is improved.⁴ Diagnostic laparoscopy allows pathology to be identified and managed optimally, affording the surgeon the opportunity of making the most appropriate incision if the need for laparotomy arises. Operating on obese patients is also easier using the laparoscopic technique, and the literature documents a decrease in postoperative wound infections in this patient population, especially the subgroup with a body mass index >26, due to near-complete avoidance of abdominal wall contamination.²²

All intraperitoneal abscesses in this series occurred with complicated, perforated appendicitis, which is associated in the literature with an increased rate of intraabdominal abscess and longer hospital stay, regardless of the operative approach.^{4,22-24} It is our opinion that the ability to focus irrigation fluid in the limited area of abscess or purulence allows the laparoscopist to aspirate nonviable debris in a more effective manner, while minimizing dispersal of microorganisms throughout the peritoneal cavity. Moreover, it has been suggested that a possible decrease in postoperative bowel obstruction may be associated with a laparoscopic approach to perforated appendicitis, possibly because of the superior visualization and decreased handling of tissue, and, therefore, decreased postoperative adhesion formation.²⁵ However, this hypothesis has yet to be scientifically proven.

Cost was not determined in this study, although it continues to be a point of controversy in the literature.⁶ It appears that the majority of the cost incurred with laparoscopic appendectomy is related to the use of disposable instruments. Perhaps a move toward reusable/multiuse instruments and trocars will allow the cost of a laparo-

scopic procedure to decline, making it more competitive with the open technique. Although some claim that overall the open appendectomy is less expensive than laparoscopic appendectomy, the fact remains that even though the equipment may be more expensive, the savings associated with decreased length of stay compensates for this factor. Finally, shorter and easier recovery time associated with a laparoscopic appendectomy costs the patient less in that they may return to work more quickly.

CONCLUSION

The widespread controversy regarding whether to use the traditional open technique or the laparoscopic technique for appendectomy is still unsettled in the literature. The results of this study of 55 consecutive laparoscopic appendectomy procedures performed by 1 surgeon trained in advanced laparoscopic techniques suggests that laparoscopic appendectomy is superior to open appendectomy with regard to the incidence of postoperative wound infection and decreased overall length of stay compared with data in the literature. Laparoscopy allowed confirmation of the clinical diagnosis of acute appendicitis and its subsequent treatment, and its value as a diagnostic tool is indisputable. It has also permitted a decrease in the number of negative appendectomies performed, which has been traditionally accepted as occurring in 15% of men and 20% of women.²⁰ It is a safe and effective technique for both complicated and uncomplicated appendicitis because it has the advantage of allowing better intraabdominal exploration and visualization, lower morbidity, shorter length of stay, and improved cosmetic results. Perhaps surgeons interested in incorporating laparoscopic appendectomies into their practice should consider acquiring advanced laparoscopic training in order to minimize possible complication rates.⁴ The results of this study have made laparoscopic appendectomy our procedure of choice, and we advocate it preferentially for patients with clinically suspected appendicitis.

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